

US EPA ARCHIVE DOCUMENT

# RESPONSE TO COMMENTS DOCUMENT

Land Disposal Restrictions--Phase IV:  
Final Rule Promulgating Treatment Standards for  
Metal Wastes and Mineral Processing Wastes;  
Mineral Processing Secondary Materials and  
Bevill Exclusion Issues; Treatment Standards for  
Hazardous Soils, and Exclusion of  
Recycled Wood Preserving Wastes

Volume 5  
Second Notice of Data Availability  
March 5, 1997

U.S. Environmental Protection Agency  
Office of Solid Waste  
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**Phase IV LDR Proposed Rule - Notice Of Data Availability, March 5, 1997**  
**Comments and Responses for**  
**Issues Related to the Addition of Iron Filings to Foundry Sand**

DCN: PH3A-0001  
COMMENTER: Chesapeake Speciality Products

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COMMENT

The commenter expresses the concern that any changes in 40 CFR 268 resulting from the foundry data may adversely impact the ability of the steel bridge maintenance industry to use steel abrasives for blast cleaning. The commenter recommends that all debris from any lead abatement project be deemed hazardous regardless of the type of abrasive.

RESPONSE

The Agency recognizes that the waste residues resulting from blast cleaning could contain a mixture of lead paint and metallic iron fines and therefore, could exhibit toxicity characteristic for lead. However, the Agency notes that the use of iron abrasives for removing lead paint from steel is part of the blast cleaning process and therefore, the presence of iron fines in the residues would not result in impermissible dilution. This is because dilution (if any) would occur as part of a process which generates a waste. A waste itself would not be being diluted. Put another way, the dilution prohibition only applies to processes that treat hazardous wastes and not for processes that generate a waste. The Agency also notes that it is beyond the scope of this rulemaking to list all lead abatement waste as hazardous. The Agency agrees with the commenter that iron abrasives waste may behave similarly to iron filings. State regulations directly address the disposal of lead abatement wastes, such that federal regulation may not be warranted at this time.

DCN: PH3A-0002  
COMMENTER: Indiana Department of Environmental Management

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COMMENT

The commenter has determined that the addition of iron fines to foundry wastes to reduce the amount of toxicity characteristic leaching procedure (TCLP) leachable lead is generally unacceptable.

RESPONSE

The Agency thanks the commenter for supporting EPA's position on this issue.

COMMENT

The commenter has in one instance accepted the addition of iron fines as treatment, based on a very specific set of circumstances. The commenter would reject the method where disposal of wastes so treated would be subjected to acid leaching and chemical oxidation, but believes it may be acceptable for brass foundries.

RESPONSE

The Agency disagrees with the commenter on this issue. The commenter's conclusion is based upon leachate testing and the absence of current groundwater contamination. The peer-reviewed studies have shown such leachate testing to be an ineffective measure of long-term metal mobility and future monitoring may show contamination, should any landfill liner fail or contamination reach the monitoring well. When effective, this action prohibits the further addition of iron fines or filings as a method of treatment for lead wastes to circumvent the land disposal prohibition imposed by RCRA section 3004.

DCN: PH3A-0003  
COMMENTER: RMT, Inc.

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#### COMMENT

The commenter believes that iron-treated foundry sand disposed in an industrial monofill does not pose a significant treat to human health or the environment, because there is no evidence of groundwater contamination for the constituents of concern at the NIBCO industrial monofill cells within the Nacogdoches Municipal Landfill. Furthermore, the commenter finds the EPA position on iron dust treatment is incorrect, biased, and technically unsound.

#### RESPONSE

The Agency disagrees with the commenter's belief that iron-treated foundry sand disposed in an industrial monofill does not pose a significant treat to human health or the environment. The commenters belief is based upon leachate testing and the absence of current groundwater contamination. The Agency notes that studies have shown such leachate testing to be an ineffective measure of long-term metal mobility and future monitoring may show contamination, should any landfill liner fail or contamination reach the monitoring well.

In response to the comment on iron dust treatment, the Agency's determination that the addition of iron filing constitutes impermissible dilution is predicated on the fact that the adsorption of soluble lead on to the iron surface is a reversible reaction and once the iron surfaces oxidize, the ability of the additive to scavenge soluble metals is diminished. Therefore, the treatment is not permanent. In addition, adsorption alone is not a reliable method of permanently immobilizing lead. The longevity of treatment cannot be measured by the TCLP test, which provides only a snapshot of the leachable constituents under the test condition at the time of analysis.

The root requirement of the land disposal restriction program is that treatment of hazardous wastes is to "substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized." RCRA section 3004(m)(1). The commenter's statement that groundwater is not yet contaminated from iron treated lead-bearing foundry wastes does not speak to this standard. The fact that even though lead is mobile but hasn't yet actually contaminated groundwater hardly satisfies a test requiring substantial reductions of mobility, and minimization of threats. Regardless of whether or not actual groundwater contamination has occurred at the subject site, it is the Agency's concern that should the landfill liners fail coupled with the absence of actual treatment, significant hazards to human health and the environment could potentially occur. It is the objective of the Land Disposal Restrictions (LDR) program to minimize such potential threats. It is also the whole premise of the LDR provisions that predicting the fate of inadequately treated land disposed hazardous wastes is inherently uncertain.

See, e.g. section 3004 (d) (1) and HWTC III, 886 F. 2d at 360-66. A mode of treatment that fails in fact to immobilize the very hazardous constituent causing the waste to be identified as hazardous does not satisfy this standard. Because the mode of treatment appears not to be having any chemical effect, EPA is designating it as a type of impermissible dilution (i.e. confirming that the practice already is prohibited under existing dilution prohibition rules).

EPA also believes that the recent decision in Columbia Falls Aluminum Co. v. EPA supports this action. In that case, the TCLP was shown to predict inaccurately actual behavior of treated wastes and it was held arbitrary for EPA to continue to rely on TCLP-based treatment standards (or at least, held that EPA had failed to justify its use of the TCLP under the circumstances). Here, EPA has found that adding iron filings to lead wastes results in inaccurate TCLP results -- the inaccuracy being an underpredicting of subsequent leaching potential (as in Columbia Falls). EPA is acting here to avoid the arbitrary result allowing land disposal when the TCLP results from initial testing of the waste are known to underpredict.

#### COMMENT

The commenter refutes the conclusion of Dr. Drexler that the foundry wastes placed in the Nacogdoches Municipal Landfill remained hazardous, in fact. There is no evidence of significant lead leaching in the Nacogdoches Municipal Landfill, therefore the TCLP does not accurately predict the level of hazard presented by the materials in the landfill.

#### RESPONSE

The Agency notes that TCLP is not a predictor of when groundwater contamination may occur at a specific site. This is contingent upon numerous variables such as the presence or absence of a liner, potential liner failure, rainfall, leachate pH, temperature, and soil porosity. The TCLP is a predictor of the mobility of constituents under the test conditions. Wastes which leach constituents under the TCLP test conditions above threshold limits are regulated as hazardous wastes. The commenter asserts that the absence of actual groundwater contamination infers that constituent mobility predicted by the TCLP is in error. This is not the case. TCLP tests performed on samples removed from various depths of the Nacogdoches landfill showed leaching of constituents in excess of the regulatory levels from 28% to 100% of the time. Therefore, Dr. Drexler concluded that "Hazardous materials were placed in the Nacogdoches landfill." Dr. Drexler's studies and conclusions were peer reviewed by an expert panel. The peer reviewers agreed that adding iron filings to spent foundry sand is not treatment of hazardous constituents. The peer reviewers also found that the scientific data presented in the studies support the conclusions reached and the studies are based on sound scientific research and fact. Therefore, the Agency reaffirms its conclusion that the addition of iron filing constitutes impermissible dilution.

Incidentally, it was reasonable to test landfilled waste using the TCLP. The purpose of such testing was to confirm that any stabilizing effect of adding iron was temporary. Kendall's report, pp. 2, 3, 14. See also comments of Peer Reviewer Dr. Thyne, page 1, making precisely

this point and accepting subsequent TCLP analysis of landfilled waste as legitimately proving “that the effect [of adding iron] is temporary and does not constitute an effective treatment.” In addition, the report of Dr. Drexler confirms that the temporary effect results from dilution. Drexler Report pp. 14, 16, 18.

#### COMMENT

The commenter agrees with the conclusion that, "The addition of iron filings to spent foundry sand does not cause chemical reduction; i.e., the hazardous lead remains oxidized." However, the commenter states that the conclusion is irrelevant, because the CFR definition of treatment makes no mention of immediate reaction.

#### RESPONSE

The issue here is not whether addition of iron filings is a type of treatment, but whether it is permissible under RCRA section 3004 (m), which includes the dilution prohibition codified in 268.3. The Agency notes that the root requirement of the land disposal restriction program is that treatment of hazardous wastes is to "substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized." RCRA section 3004(m)(1). The addition of iron filing results in no modification of the physical, chemical, or biological character of the waste. The addition of iron filings facilitates the adsorption of soluble lead on to the iron surface. Drexler Report p. 18. However, once the iron surfaces oxidize, the ability of the additive to scavenge soluble metals is diminished. *Id.* Therefore, this is a reversible reaction and is not permanent. *Id.* In addition, adsorption alone is not a reliable method of permanently immobilizing lead. Kendall Report p. 3. Therefore, in the long-term, the migration of hazardous constituents is not retarded and thus, the requirements of RCRA 3004(m) are not fulfilled.

#### COMMENT

The commenter asserts that adsorption of heavy metals by metal oxides (and particularly iron oxide) is a widely accepted method of treating hazardous waste and wastewater and reducing the mobility of metals in environmental systems. Therefore, the beneficial effects are obtained through adsorption of metal ions by iron oxide, and EPA errs in terming this "impermissible dilution."

#### RESPONSE

The Agency notes that the adsorption of heavy metals by metal oxides is widely used for precipitating metal constituents in wastewaters. The precipitated residues have to be further treated, for example stabilized to immobilize the metal constituents in the residues prior to disposal. Adsorption, in this case, is only used to precipitate the metals, not for immobilizing the

metals. Therefore, adsorption alone is not a form of effective treatment. In the case of foundry wastes, the addition of iron filings facilitates the adsorption of lead by iron oxides. Under certain circumstances enough lead can be adsorbed so that lead in the TCLP extract is below the regulatory levels. However, once the metal surface is oxidized, adsorption is reduced, and environmentally exposed samples are found to leach contaminants in excess of regulated levels. Drexler Report pp. 14, 16, 18. This contention is confirmed by TCLP tests done on waste sand from the Nacogdoches landfill. This type of management fails to meet the root requirement of RCRA 3004 (m)(1) and therefore, since the temporary adsorption is a dilution effect (*id.*), is considered impermissible dilution.

#### COMMENT

The commenter states that Dr. Drexler's conclusion that "The addition of iron filing changes the leaching fluids characteristics by: increasing pH, lowering Eh and DO to levels that are unlike most natural environments." (Drexler- p. 1 6) is irrelevant. Treatment with iron reduces the mobility of lead under leaching conditions in landfills, as evidenced by the fact that no significant concentrations of lead have been measured in site.

#### RESPONSE

Dr. Drexler concludes that the environment created in the initial testing of the waste after iron filings are added is unlike "most natural environments." The Agency infers from this that the immediate test conditions would not be representative of the long-term landfill conditions. In an actual landfill, oxygen would diffuse in to oxidize the metal filings increasing Eh and DO, decreasing pH. This would act to remove the initial adsorption of lead on the iron filings and result in leaching toxic levels of lead into the environment. This is evident from the TCLP tests done on waste sand from the Nacogdoches landfill that showed lead concentrations in the extracts ranging from 2.81 mg/l to 11.6 mg/l. Therefore, the addition of filings gives but a temporary effect unlike the long lasting effects obtained through microencapsulation or other true treatment technologies which substantially reduce metal mobility.

#### COMMENT

The commenter maintains that it is desirable that the treatment of hazardous waste also reduce its bioavailability. However, RCRA does not provide for regulation of this aspect where materials are to be disposed in a suitable disposal facility.

#### RESPONSE

In vitro testing conducted by Dr. Drexler shows that the subject "treated" spent foundry sands maintain a high bioavailability of lead (for detailed information on the tests see "Dr. Drexler, Phase I- Characterization of Iron Filings Treatment Method of Foundry Sands" pp. 16-17, in the RCRA Docket for today's rulemaking). The Agency notes that the statement on bioavailability of

lead was not intended to suggest the failure to meet a RCRA requirement, but was intended to provide further scientific evidence that the "treatment" was not successful. However, bioavailability is in fact an issue in cases where an ineffective type of treatment permits escape of hazardous materials to the environment where human and other biota can be exposed. Furthermore, RCRA requires that treatment of hazardous wastes "substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized." RCRA section 3004(m)(1). The Agency concludes that the addition of filings has not acted to minimize treats in the long-term and therefore since the ineffectiveness reflects a dilution phenomenon, is "impermissible dilution."

#### COMMENT

The commenter notes that it is possible for the same sample to be classified as hazardous by the TCLP test when the prior EP test would have indicated the waste was not hazardous.

#### RESPONSE

The TCLP has replaced the EP in the regulatory definition of hazardous waste. See 55 FR 11862, March 29, 1990. The TCLP and EP test differences were not at issue in this rule.

#### COMMENT

The commenter finds the sampling to be biased as opposed to random sampling, and is of the opinion that it is unlikely that EPA would have allowed them to conduct a biased investigation of Cell I only in areas that had very low EP Toxicity Test results, and pool them with other unbiased data sets to prove treatment effectiveness.

#### RESPONSE

In the determination of whether a waste is hazardous Agency guidance at SW-846 Chapter Nine provides basic sampling strategies for simple and stratified random sampling of the waste as a whole. However, in application of the land disposal treatment standards all portions of the waste must meet the applicable treatment standards, i.e., no portion may exceed the regulatory limit. To meet the "total waste and waste extract" treatment standards data pooling or averaging is not allowed. See 40 CFR 268.40; Chemical Waste Management, 976 F.2d at 34. The hot spots sampled by Dr. Drexler show areas of inadequate or degraded "treatment" in the cell.

#### COMMENT

The original purpose of the sampling was to assist with an ongoing legal matter between the foundry and EPA. EPA has used portions of this biased legal investigation as a basis for a "scientific investigation." The commenter believes the results and conclusions that the treatment does not work, are largely wrong.

## RESPONSE

While the commenter is correct in that the studies were in support for a legal investigation, the EPA disputes the commenter's assertions that studies are biased and the conclusions are largely wrong. The Agency, in order to receive an unbiased opinion on Dr. Drexler and Dr. Kendall's studies, subjected the studies to peer review. A panel of three peer reviewers, Dr. Abinash Agrawal of Wright State University, Dr. Carl Palmer of the Oregon Institute of Science and Technology, and Dr. Geoffrey Thyne of California State University at Bakersfield reviewed the studies. The peer reviewers concluded that (1) addition of iron filings to spent foundry sand is not treatment of hazardous waste constituents, (2) the scientific data presented in the studies support the conclusions reached by the studies, and (3) the conclusions are based on sound scientific research and fact.

The Agency also notes that the RCRA 3004(m)(1) requires that treatment must substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized." This is the standard the Agency must uphold. The Agency is unpersuaded by the commenter's arguments and is finalizing its determination that the addition of iron filings as a treatment process constitutes prohibited "impermissible dilution." (40 CFR 268.3).

## COMMENT

The commenter agrees with the comment of [peer-reviewer] Dr. Palmer that there is a lack of documented QA/QC for Dr. Kendall's analytical report and the sampling plan prepared by Dr. Drexler. The commenter also observed that equipment was decontaminated before and between boring locations, but some of the equipment was simply placed on the floor of the pad, and not placed on racks and wrapped in plastic for transport to the next sampling location. Additionally, the drilling crew used the same cotton gloves from the drilling operation during decontamination, rather than disposable gloves, which would avoid the potential to introduce cross-contamination.

## RESPONSE

The Agency notes that in response to the comment on the lack of QA/QC documentation, detailed descriptions on the QA/QC procedures have been collected and reviewed. These documentation are included in the RCRA docket for today's rule. The results of the QA/QC review concluded that the analytical methods and the sampling plans conducted by Dr. Kendall and Dr. Drexler respectively are acceptable for the intended purpose. Specifically, regarding the potential of cross-contamination during sampling, the commenter observed that the equipment was properly decontaminated between samples and takes issue only with the potential for contamination through the touching of the cleaned and decontaminated equipment with used gloves leaves room for potential cross-contamination. The QA/QC review of the sampling procedures ruled out the possibility of any cross-contamination and therefore, the Agency is not

persuaded by such arguments that the sampling was in any way biased.

#### COMMENT

The commenter reports that the UCL, or upper confidence interval (CI) to be calculated in error.

#### RESPONSE

The Agency believes that Dr. Drexler handled the data in a uniform manner and that his analysis of the data and that of the commenter lead to the finding that a significant portion of cell-1-8 contains wastes that are hazardous. Dr. Drexler labels the UCL calculated as 90% and 95 %, so there is no assumption they are the 80% (i.e., 0.2 probability) two-tailed confidence interval for determination of regulatory compliance. Fifty percent of the samples from cell I grid 8 are in excess of the regulatory limit. If only one sample had failed, the Agency would still view the waste as a whole to be inadequately treated. If the cell were a newly generated waste for disposal, then if the upper limit is equal to or greater than the regulatory threshold the waste is hazardous. (SW-846, Nine-6).

The numerous "hot spots" of hazardous material within the municipal landfill that is not permitted nor designed to handle such waste led Dr. Drexler to state, "I believe the Agency should use a more conservative approach in the evaluation of this site than is presented by RMT/NIBCO or SW-.945." Therefore, sampling was focused on the known "hot spots."

#### COMMENT

Given the biased sampling, disregard for SW-846 statistical analysis, the lack of adherence to proper QA/QC, and the computational flaws in this study, the EPA should reconsider its classification of the treatment of foundry sands with iron as ineffective.

#### RESPONSE

The EPA has evaluated each of the commenter's concerns with the subject studies, and finds that the arguments are not persuasive nor did the peer reviewers. The QA/QC procedures were reviewed and the results of the QA/QC review concluded that the analytical methods and the sampling plans conducted by Dr. Kendall and Dr. Drexler respectively are acceptable for the intended purpose and not in any way biased.

DCN: PH3A-0004  
COMMENTER: NIBCO, Inc.

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COMMENT

It is NIBCO's position that the studies conducted were not based on sound science. Field sampling and the resultant data is not statistically valid nor representative of the site being presented as evidence and therefore not suitable technically to modify current regulations. Dr. Kendall states that conclusions are based on data from the Nacogdoches, Texas landfill which received NIBCO foundry sand treated with iron filings/dust. However, conclusions from a more thorough and scientific study conducted earlier under the direction, approval, and oversight of the USEPA differ significantly. This study included a full characterization of the landfill using SW-846 sampling guidelines. Analysis of the complete set of data identified several localized hot spots but resulted in a classification for the entire monofil as non-hazardous.

RESPONSE

The Agency disagrees with the commenter that the studies conducted by Dr. Drexler, and Dr. Kendall are not based on sound science. The Agency, in order to receive an unbiased opinion on Dr. Drexler and Dr. Kendall's studies, subjected the studies to peer review. A panel of three peer reviewers, Dr. Abinash Agrawal of Wright State University, Dr. Carl Palmer of the Oregon Institute of Science and Technology, and Dr. Geoffrey Thyne of California State University at Bakersfield reviewed the studies. The peer reviewers concluded that (1) addition of iron filings to spent foundry sand is not treatment of hazardous waste constituents, (2) the scientific data presented in the studies support the conclusions reached by the studies, and (3) the conclusions are based on sound scientific research and fact.

In addition, to determine whether a waste is hazardous or not, EPA's guidance at SW-846 Chapter Nine provides basic sampling strategies for simple and stratified random sampling of the waste as a whole. However, in application of the land disposal treatment standards all portions of the waste must meet the applicable treatment standards, i.e., no portion may exceed the regulatory limit. The hot spots sampled by Dr. Drexler show areas of inadequate or degraded "treatment" in the cell. To meet the "total waste and waste extract" treatment standards, data pooling or averaging is not allowed. See 40 CFR 268.40.

Regarding the comment on EPA's earlier study, the Agency notes that the report on Iron Chemistry in Lead Contaminated Materials (February 22, 1994), specifically on the iron treatment of foundry sands, found that iron lead bonds are weak adsorptive surface bonds, and therefore, are not likely to result in permanent treatment. Furthermore, the study found that when the iron-rich mixture is exposed to moisture and oxidative conditions over time, interstitial water would likely acidify. This could potentially reverse any temporary stabilization, as well as increase the

leachability of the lead from the foundry sand. Therefore, the report concluded that the addition of iron dust or filings to characteristic waste foundry sand does not provide long-term treatment.

#### COMMENT

The studies currently under review appeared to be conducted with pre-conceived biases which differ significantly from the scientific random sampling method used in the earlier work.

For example:

- Data used in the studies open for comment were generated from samples specifically pulled from previously identified "hot spots", not at all representative of the total landfill volume but designed to "... better characterize the geochemistry of a 'hot spot'" per Dr. Kendall.
- Assumptions were made as to the oldest material in the landfill based on depth. Actual landfill records do not support that assumption and consequently cannot be used to support Dr. Drexler's resulting theory of "absence of long term treatability".
- Samples were inappropriately combined for some analyses which could bias the results.

Further, peer review, by the nature of information supplied, assessed Dr. Kendall's and Dr. Drexler's conclusions based on limited data presented in these specific studies. Complete geostatistical data was not supplied for peer review and reviewers were not made aware of the designed bias of the sampling. One statement in the peer review makes this quite clear. Dr. Thyne stated, "*This is a high rate of failure for randomly collected samples*". Obviously, he was not aware of the non-random nature of the data.

Still further, Dr. Drexler's evaluation of bioavailability is not appropriate. The basis of Toxic Characteristic determination for lead, relative to land disposal, is leachability to ground water, not direct uptake of material. Disposal in a controlled landfill effectively eliminates significant risk from direct uptake.

In summary, Dr. Kendall and Dr. Drexler reached the conclusion of ineffectiveness of treatment and made the recommendation to discontinue the practice based on a select set of data not representative of the entire fill. Peer review was similarly narrow in focus. As a result, no valid general statement can be made, based on this work, as to the overall effectiveness of treatment of foundry sand with iron fillings/dust.

Statistically valid data, obtained from an unbiased study is the only suitable foundation for rulemaking. In order to provide such a basis for the regulatory changes under consideration, further study is required. That work should include, at a minimum:

- Reassessment of the treatment of lead containing foundry sand with iron dust/filings based on statistically valid sampling, including all applicable data, to objectively determine overall effectiveness.

- A review of iron dust addition effectiveness data as presented in response to previous public comment per docket F-95-PH3P-FFFFF
  - NIBCO Inc. - Mr. Ralph Showman
  - American Foundrymen's Society (AFS) - Mr. Gary Mosier
  - RMT - Madison, Wisconsin

In conclusion, credence should not be given to reports which are not based on proper statistical methods nor sound science. NIBCO maintains its position that treatment of lead bearing wastes with metallic iron does effectively prevent the leachability of lead in a landfill, and that legitimate, unbiased, scientific study supports this position. This conclusion is the culmination of several years of case development, trial preparation, and legitimate research. Drexler's and Kendall's conclusions were preconceived and their methods were narrowly focused to support their preconceived conclusions.

NIBCO hereby requests that the USEPA take into consideration the studies that were already conducted under the direction of the agency or, in the alternative, perform additional studies using appropriate scientific methods, i.e., SW-846 guidelines. We are confident that each approach will confirm the long term effectiveness of the iron dust treatment method.

## RESPONSE

The Agency notes that the statement on bioavailability of lead was not intended to suggest the failure to meet a RCRA requirement, but was intended to provide further scientific evidence that the "treatment" was not successful. However, bioavailability is in fact an issue in cases where an ineffective treatment permits escape of hazardous materials to the environment where human and other biota can be exposed.

Regarding the comment on sampling "hot spots," the Agency notes that the frequency of observed "hot spots" in the Nacogdoches landfill directly reflects the inefficiency of the "treatment." Since the objective of the study was to determine whether the contaminants in treated waste are effectively immobilized, sampling known "hot spots" is appropriate. This approach is essential to evaluate the extent to which hazardous materials were placed in the landfill. Hot spots leach toxic metals. Continued leaching of toxic metals from the waste, be it from a "hot spot" or some other portion, shows ineffective treatment. This sampling procedure is also consistent with the LDR regulations. 40 CFR Part 268, Subpart D, Section 268.4(b) states that "for all nonwastewaters, compliance with concentration level standards is based on grab sampling." This means that every grab sample must meet the regulatory limits for all hazardous constituents.

Put another way, all of the waste must be effectively treated not some bits of it.

The Agency, in order to receive an unbiased opinion on Dr. Drexler and Dr. Kendall's studies, subjected the studies to peer review. A panel of three peer reviewers, Dr. Abinash Agrawal of Wright State University, Dr. Carl Palmer of the Oregon Institute of Science and

Technology, and Dr. Geoffrey Thyne of California State University at Bakersfield reviewed the studies. The peer reviewers concluded that (1) addition of iron filings to spent foundry sand is not treatment of hazardous waste constituents, (2) the scientific data presented in the studies support the conclusions reached by the studies, and (3) the conclusions are based on sound scientific research and fact. In addition, QA/QC procedures from the studies were reviewed and the results of the QA/QC review concluded that the analytical methods and the sampling plans conducted by Dr. Kendall and Dr. Drexler respectively are acceptable for the intended purpose and is not in any way biased.

In addition, to determine whether a waste is hazardous or not, EPA's guidance at SW-846 Chapter Nine provides basic sampling strategies for simple and stratified random sampling of the waste as a whole. However, we repeat that, in application of the land disposal treatment standards all portions of the waste must meet the applicable treatment standards, i.e., no portion may exceed the regulatory limit. The hot spots sampled by Dr. Drexler show areas of inadequate or degraded "treatment" in the cell. To meet the "total waste and waste extract" treatment standards, data pooling or averaging is not allowed. See 40 CFR 268.40.

#### COMMENT

Dr. Kendall, *'Samples collected from the thickest portions of the cell-1-8 were specifically chosen to better characterize the geochemistry of a 'hot spot.'* This is in direct disagreement with SW-846 and well accepted statistical sampling techniques. Select, intentionally biased data can not legitimately be used to characterize the entire fill volume.

#### RESPONSE

Application of the land disposal treatment standards requires all portions of the waste meet the applicable treatment standards, i.e., no portion may exceed the regulatory limit. To meet the "total waste and waste extract" treatment standards data pooling or averaging is not allowed. See 40 CFR 268.40. The hot spots sampled by Dr. Drexler show areas of inadequate or degraded "treatment" in the cell. In the subject rulemaking, whether or not the entire landfill cell contains a hazardous waste is irrelevant. If part of the waste in the cell is either inadequately treated, or the effects of the treatment dissipate quickly, then the treatment process is not sufficient to satisfy RCRA 3004(m) (1). The Agency remains convinced that the addition of iron filings is but a temporary method of circumventing regulation and is codifying that this process constitutes prohibited "impermissible dilution."

The Agency, in order to receive an unbiased opinion on Dr. Drexler and Dr. Kendall's studies, subjected the studies to peer review. A panel of three peer reviewers, Dr. Abinash Agrawal of Wright State University, Dr. Carl Palmer of the Oregon Institute of Science and Technology, and Dr. Geoffrey Thyne of California State University at Bakersfield reviewed the studies. The peer reviewers concluded that (1) addition of iron filings to spent foundry sand is not treatment of hazardous waste constituents, (2) the scientific data presented in the studies support the conclusions reached by the studies, and (3) the conclusions are based on sound scientific

research and fact.

#### COMMENT

Dr.Kendall, *“whether materials containing over 1000 mg/kg lead should be considered non-toxic just because they pass the TCLP test is not a subject for this report.,,*

Any conclusions reached from the use of these reports must weigh the efficacy of treatment with iron and not the total level of lead present. Dr. Palmer's comments are appropriate where he states:

Dr. Palmer, *'The use of FeO is a legitimate test of a potential treatment method. Secondly, I believe that the TCLP test on the treated materials is appropriate. You correctly stated that 'The addition of filings changes the reaching fluids characteristics by: increasing pH and lowering Ek and DO levels that are unlike natural environments.' However, that is the goal of the treatment. Passing the TCLP is a necessary but not sufficient condition for waste stabilization. '*

NIBCO agrees with the commenter that passing of the TCLP test (or EP Toxicity test where appropriate) is necessary and that it must be coupled with long term stability. NIBCO's comments are not aimed at the effectiveness of treatment with metallic iron, as that issue has been proven and documented in Public Comments to Docket #F-95-PH3P-FFFFF in April of 1995. These reports discuss long term as well as short term treatability. The EP-Toxicity as well as the TCLP tests were developed to predict long term (100 years) leachability under worst case conditions of a municipal solid waste landfill. In addition, these previous reports used the Multiple Extraction Leaching Procedure (MELP) in which successive leaching tests are performed to further predict long term (> 100 years) effectiveness. These studies support the long term effectiveness of the metallic iron treatment technology.

#### RESPONSE

The Agency notes that, under the conditions of the TCLP, the presence of iron reduces the observed soluble concentration of lead in the leachate solution. However, this effect is short lived and once the metal surface is oxidized the studies presented show the effect is reduced or nonexistent. With regard to the comment on the MELP, the Agency agrees that both TCLP and MELP are acceptable analytical procedures. However, the Agency notes that the MELP is designed to test the leachability of constituents on a longer term and therefore, a sample that passes the MELP is very unlikely to fail the TCLP. The Agency also notes that the commenter did not provide any information on the analytical procedures and results of the MELP tests, other than simply stating that the results support long-term effectiveness. In addition, the Agency notes that the RCRA regulations, as stated in 40 CFR 261.4(a), require TCLP, test method 1311 to determine whether the leachate exhibits a hazardous characteristic.

#### COMMENT

Dr. Drexler, *'The addition of iron filings changes the leaching fluid characteristics by; increasing pH, and lowering Eh and DO levels that are unlike most natural environments. "'* The TCLP test, as designed, decreases pH and changes leaching fluids to levels that are unlike most natural environments. It is a proven fact that natural leaching environments especially in monofills do not cause lead to leach (with or without the presence of metallic iron.)

RESPONSE

The pH of the TCLP test is representative of the leachate of municipal landfills, which at the time of the test development were receiving significant amounts of industrial wastes. As it happens, because the foundry wastes pass the TCLP, they could be disposed in municipal landfills.

COMMENT

Dr. Drexler's - 'Absence of long term treatability' theory:  
*"It is perhaps any one, or combination (of) the previous processes that has caused deeper, older samples from the landfill which now contains large portions of metal-saturated (based on EMPA analysis) AIH (little zero-valent iron remaining) to consistently fail TCLP. ,*

- Landfill records will verify that cell 8 was among the more recently filled grids.
- TCLP results from 1993 and 1995 clearly show that failures cannot be conclusively tied to duration in the landfill or depth of fill.

NIBCO/RMT Characterization (1993) Cell #1 Grid #8

Depth	RMT/EPTOX	M&E TCLP	M&E EPTOX
2-4 ft	13	18.8	3.7
4-6 ft	20	4.3	13.2
6-10 ft	1.7	.66	3.7
12.9-17 ft	2.4	2.5	1.5
17-19 ft	23	13.3	8.5

EPA/AT Kearney Sampling (1995) Cell #1 Grid #8. Split samples Tested by RMT

Depth	Boring #1		Boring #2		Boring #3	
	RMT	ATK	RMT	ATK	RMT	ATK
2.5-3.5 ft	.93	5.8	2.45	11	1.4	3.0
4-9 ft	1.6	<.22	1.6	1.6	8.4	2.8
9013.8 ft	1.4	.75	1.3	1.3	1.8	2.4
14-19 ft	.41	2.4	3.2	5.7	2.4	1.5
19-22.5 ft	39	65			28	23.7

RESPONSE

TCLP tests performed on samples removed from various depths of the Nacogdoches landfill showed leaching of constituents in excess of the regulatory levels from 28% to 100% of the time. Therefore, Dr. Drexler concluded that "Hazardous materials were placed in the Nacogdoches landfill." Dr. Drexler's studies and conclusions were peer reviewed by an expert panel. The peer reviewers agreed that adding iron filings to spent foundry sand is not treatment of hazardous constituents. The peer reviewers also found that the scientific data presented in the studies support the conclusions reached and the studies are based on sound scientific research and fact.

With respect to the comment on cell 8, the Agency notes that, although there is significant variability at any one depth of cell 8, a consistent trend of higher values at the lowest level is observed. Since these are the first wastes deposited, it is correctly presumed that these deposit have been in the landfill the longest, and that Dr. Drexler's observations is borne out by the data presented. That cell 8 is not one of the more recent cells completed, further proves the short term adsorption of lead on the iron metal surface is not a lasting treatment.

#### COMMENT

##### Comments on Peer Reviewers

It appears that all of the commenters used the statement of high failure rates as the basis for their agreement with the author's conclusion that the material remains hazardous. No actual data was submitted with Dr. Drexler's report and his failure percentages are in direct disagreement with results obtained from RMT/NIBCO, and Metcalf & Eddy (M&E)/USEPA. This disagreement results from Dr. Drexler's conclusion being based on a select subset of data from an identified, localized, hot spot, i.e. Grid #8 and makes generalizations based on this distinct data subset. This process ignored the remainder of the data. The resulting statement of high failure rate is misleading and does not accurately characterize the cell overall nor does it provide evidence to support the statement as to the general effectiveness of treatment with metallic iron.

#### RESPONSE

Failure rates of 28%, 25%, 50% and 100% were reported by Dr. Drexler (Drexler, page 5). The Agency notes that whether or not all the material in the cell exhibits the characteristics of a hazardous waste is not the objective of the studies conducted by Dr. Drexler and Dr. Kendall. The objective of the study was to determine whether the contaminants in treated waste are effectively immobilized and therefore, sampling known "hot spots" is appropriate. This approach is essential to evaluate the extent to which hazardous materials were placed in the landfill and threats posed by disposal are minimized. This sampling procedure is also consistent with the LDR regulations. 40 CFR Part 268, Subpart D, Section 268.4(b) states that "for all nonwastewaters, compliance with concentration level standards is based on grab sampling." This means that every grab sample must meet the regulatory limits for all hazardous constituents.

With respect to the comment on cell 8, the Agency notes that, although there is significant

variability at any one depth of cell 8, a consistent trend of higher values at the lowest level is observed. Since these are the first wastes deposited, it is correctly presumed that these deposit have been in the landfill the longest, and that Dr. Drexler's observations is borne out by the data presented. That cell 8 is not one of the more recent cells completed, further proves the short term adsorption of lead on the iron metal surface is not a lasting treatment.

#### COMMENT

Dr. Agrawal, "*The report should adequately describe the protocol of sample collection from the landfill and their preservation prior to analysis.*"

This exemplifies the significance of, and concern over, sampling protocol and its impact on conclusions.

Dr. Agrawal states that the protocol of sample collection should be adequately described. Dr. Drexler's answer is that Sampling protocol and QA/QC are available on request. Because the sampling clearly was a review of hot spots and not random sampling as described in SW-846, any results obtained should not be used to promulgate regulations. Dr. Agrawal's request clearly states his concern with, and the significance of, sampling protocols within these types of studies. Dr. Agrawal's summary does not support Dr. Kendall's conclusion.

*'In summary, the present investigation needs to conclusively show the formation of PbO by reduction of aqueous Pb<sup>2+</sup> with iron metal, or lack of it. Only then, the effectiveness or failure of the reduction technique by iron metal can be evaluated for field applications.*

Based on Dr. Agrawal's comments, more data is needed to reach a conclusion. The USEPA should not consider modifications to regulations based on an incomplete and biased study.

#### RESPONSE

In the determination of whether a waste is hazardous, Agency guidance at SW-846 Chapter Nine provides basic sampling strategies for simple and stratified random sampling of the waste as a whole. However, in application of the land disposal treatment standards, all portions of the waste must meet the applicable treatment standards, i.e., no portion may exceed the regulatory limit. The Agency notes that the frequency of observed "hot spots" in the Nacogdoches landfill directly reflects the ineffectiveness of the "treatment." Furthermore, the objective of the studies conducted by Dr. Drexler and Dr. Kendall was to determine whether the contaminants in treated waste are effectively immobilized and therefore, sampling known "hot spots" is appropriate. This approach is essential to evaluate the extent to which hazardous materials were placed in the landfill. This sampling procedure is also consistent with the LDR regulations. 40 CFR Part 268, Subpart D, Section 268.4(b) states that "for all nonwastewaters, compliance with concentration level standards is based on grab sampling." This means that every grab sample must meet the regulatory limits for all hazardous constituents. This also is in accord with the overall object of the LDR program: that threats posed by land disposal be minimized, not just that a portion of those threats (representing parts of a waste which have been treated) are

minimized. This is why the treatment standards are enforced by means of grab sampling.

The Agency notes that in response to the comment on the lack of QA/QC documentation, detailed descriptions on the QA/QC procedures have been collected and reviewed. These documentation are included in the RCRA docket for today’s rule. The results of the QA/QC review concluded that the analytical methods and the sampling plans conducted by Dr. Kendall and Dr. Drexler respectively are acceptable for the intended purpose. The QA/QC review of the sampling procedures ruled out the possibility of any cross-contamination and therefore, the Agency is not persuaded by such arguments that the sampling was in any way biased.

COMMENT

Dr. Palmer, *'There is a surprising lack of QA/QC for a document that may be used to generate regulations.'*

Specific anomalies were noted in Table 2 for Samples NIB08-R & 09-R where TCLP results were excessive compared to total readings. These results are not possible by definition and it does indicate a lack of Quality Control. The question is raised concerning data recorded in Table 2 on Page 23 of Dr. Kendall's report (see below). The protocol in the TCLP test starts with the addition of 2 liters (2000 grams) of the appropriate leaching solution to a 100 gram sample of the material. The TCLP test then measures leachability in a specific leaching medium. Because the initial process represents a 20:1 dilution factor, the maximum potential TCLP leachability can be no more than 1/20th of the total lead present prior to the addition of appropriate leaching solution. The following two results which appear in Table 2 are in contradiction with each other. Based on this obvious error, coupled with questions from several of the commenters, it is felt that a report of this significance should include all of the sampling data, statistical methods used, and sampling protocol. If a peer review is conducted with all of the data and documentation available it is felt that even more questions will be raised by the reviewers. In addition to the existing peer review, it would be appropriate to have a technical review performed by someone with a working knowledge of the TCLP test and associated statistical protocols.

<u>Table 2</u>	Page 23 (Dr. Kendall's Report)	
	Total Lead	TCLP Lead
NIB 08-R	13.0	3.6
NIB 09-R	<2.0	0.22

RESPONSE

The commenter notes that the TCLP results infer total lead in sample NIB08-R of 72 mg/kg and 4.4 mg/kg in sample NIB09-R; results significantly higher than the reported total lead measurements. The Commenter presents this to be as a obvious error when in point of fact the data

has shown samples within the same cell to vary over an order of magnitude in total lead concentration. In addition, the Agency also notes that the results of the QA/QC review concluded that the analytical methods and the sampling plans conducted by Dr. Kendall and Dr. Drexler respectively are acceptable for the intended purpose.

#### COMMENT

Dr. Thyne, *This is a high rate of failure for randomly collected samples.*

Dr Thyne was obviously not aware that the study he was reviewing was not based on randomly selected samples and therefore not suitable for characterizing the entire cell.

Dr. Thyne bases his agreement on the fact that *"This report presents scientific data such as chemical analyses of TCLP extracts. Specifically, 44% of the landfill samples failed the TCLP test for lead (>5.0 mg/l) in spite of being treated with iron filings "* The 44% failure rate is inconsistent with the larger full scale sampling/characterization performed by NIBCO/RMT with confirmation results by USEPA/M&E. Dr. Thyne's comments are based on the assumption that the data used to generate his report are representative where in fact selective data was used to, *as stated by Dr. Drexler, "...better characterize the geochemistry of a 'hot spot'"*

Dr. Thyne states that "From 28 to 100% of landfill samples from four separate locations failed the TCLP for lead even though they were "treated" with iron filings. This is a high rate of failure for randomly collected samples." What Dr. Thyne obviously wasn't aware of is that these were not randomly collected samples, but rather a well prepared subset of the random and non-random sampling events and should not be used to influence the characterization of an entire landfill or an entire treatment process. These data were an attempt to characterize the geochemistry of a 'hot spot'.

The primary concern here is the statistical validity of any conclusions drawn.

#### RESPONSE

As presented by the commenter Dr. Thyne's statements do appear to be based on the assumption that the sampling was random. However, Dr. Drexler report clearly states. " Samples collected prior to 1995 were randomly collected from NIBCO cells. Those collected in 1995 were collected from the thickest portion of the cell to provide the greatest historical information. Samples collected from the thickest portions of Cell- 1-8 were specifically chosen to better characterize the geochemistry of a "hot spot." [Emphasis added, Drexler p. 5-6]. The commenters concern with statistical validity is misplaced in the subject action.

#### COMMENT

Peer review highlighted issues with regard to the understanding of the chemistry involved and assumptions as to the randomness of data.

Dr. Agrawal, *'In summary, the present investigation needs to conclusively show the formation of PbO by reduction of aqueous PB +2 with iron, or lack of it. Only then, the effectiveness or failure of the reduction technique by iron metal can be evaluated for field applications. '*

Based on this comment, more data is needed before an effective conclusion can be drawn..

Dr. Palmer, *"The use of FeO is a legitimate test of a potential treatment method. Secondly, I believe that the TCLP test on the treated materials is appropriate. You correctly stated that 'The addition of filings changes the reaching fluid's characteristics by: increasing pH and lowering Eh and DO levels that are unlike natural environments. However, that is the goal of the treatment. Passing the TCLP is a necessary but not sufficient condition of waste stabilization. "*

This is validation that leachability not total lead is the appropriate criteria for classification of lead containing materials as non-hazardous for land disposal.

Dr. Abinash Agrawal, *'The report should adequately describe the protocol of sampling collection from the landfill and their preservation prior to analysis. '*

Dr. Kendall combined several samples and altered the TCLP Extractions (46 hour) which is not within the acceptable protocol of SW-846 and therefore should not have been used to judge the efficacy of treatment with iron. If Dr. Kendall does not agree with the approved TCLP (method 131.1), his efforts should be aimed at the modification of these accepted protocols as published in SW-846 before using these new procedures to influence regulatory changes..

Although Dr. Kendall did not report the non-statistical bias of this sampling event, he did state *"Samples collected from the thickest portions of Cell-1-8 were specifically chosen to better characterize the geochemistry of a 'hot spot'."* This is in direct disagreement with SW-846 and well accepted statistical sampling practices.

## RESPONSE

The Agency notes that the peer review comments were thoroughly addressed by Dr. Drexler and Dr. Kendall and the peer review panel concluded that (1) addition of iron filings to spent foundry sand is not treatment of hazardous waste constituents, (2) the scientific data presented in the studies support the conclusions reached by the studies, and (3) the conclusions are based on sound scientific research and fact. See "Peer Review Report, September 3, 1996, submitted by A.T. Kearney, Inc., Dallas, Texas to Rena McClurg, Regional Project Officer, USEPA, Dallas, Texas, in the RCRA docket for today's rulemaking for detailed information on the peer reviewers conclusions.

With respect to the comment on sampling "hot spots," the Agency notes that in determining whether a waste is hazardous, EPA guidance at SW-846 Chapter Nine provides basic sampling strategies for simple and stratified random sampling of the waste as a whole. However, in application of the land disposal treatment standards, all portions of the waste must meet the applicable treatment standards, i.e., no portion may exceed the regulatory limit. The Agency notes that the frequency of observed "hot spots" in the Nacogdoches landfill directly reflects the

inefficiency of the “treatment.” Furthermore, the objective of the studies conducted by Dr. Drexler and Dr. Kendall was to determine whether the contaminants in treated waste are effectively immobilized and therefore, sampling known “hot spots” is appropriate. This approach is essential to evaluate the extent to which hazardous materials were placed in the landfill. This sampling procedure is also consistent with the LDR regulations. 40 CFR Part 268, Subpart D, Section 268.4(b) states that “for all nonwastewaters, compliance with concentration level standards is based on grab sampling.” This means that every grab sample must meet the regulatory limits for all hazardous constituents. This also is in accord with the overall object of the LDR program: that threats posed by land disposal be minimized, not just that a portion of those threats (representing parts of a waste which have been treated) are minimized. This is why the treatment standards are enforced by means of grab sampling.

The Agency also notes that Dr. Drexler’s and Dr. Kendall’s analytical and sampling procedures are adequately described in the report. The Agency also subjected the QA/QC procedures followed by Dr. Drexler and Dr. Kendall for review. These documentation are included in the RCRA docket for today’s rule. The results of the QA/QC review concluded that the analytical methods and the sampling plans conducted by Dr. Kendall and Dr. Drexler respectively are acceptable for the intended purpose. The QA/QC review of the sampling procedures ruled out the possibility of any cross-contamination and therefore, the Agency is not persuaded by such arguments that the sampling was in any way biased.